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Technical Memorandum

VIA EMAIL

Date: March 28, 2006 Project No: 857.39

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From: Michael A. Palmer, PG 5915, CHG 146 Roger A. Niemeyer, PG 3616, CHG 43

Re: Interim Data Deliverable, Injection Test at Pilot Injection Well G-IW-2, Montrose Site,
Torrance, California

As requested, this Technical Memorandum transmits data collected during the constant rate injection test performed at pilot injection well (PIW) G-IW-2 which was installed in the Gage aquifer east of the Montrose property. This interim data deliverable is being provided in advance of the Pilot Testing Completion Report which will be prepared and submitted at the conclusion of the pilot testing program to allow U.S. Environmental Protection Agency (EPA) to review and evaluate the test results.

The pilot injection test was conducted in general accordance with the Pilot Extraction and Aquifer Response Test Workplan Revision 4.0 (Pilot Test Workplan) dated August 12, 2005, prepared by Hargis + Associates, Inc. on behalf of the Montrose Chemical Corporation of California. The Pilot Test Workplan was approved by EPA on August 18, 2005. The testing at PIW G-IW-2 included a one-day step injection test conducted on October 13, 2005, and a constant rate injection test that was initiated on October 17, 2005 and completed on

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October 22, 2005. The CD attached to this Technical Memorandum contains the injection system operational data, as well as the manual and transducer water-level data collected during the 5-day constant-rate injection test conducted at PIW G-IW-2.

Well Construction

PIW G-IW-2 was constructed between August 18 and August 26, 2005. The well was completed in the Gage aquifer with the screen interval set at 174 to 214 feet below land surface. Well construction details are provided in attached Figure 1 for reference. The well was subsequently developed between August 29 and September 21, 2005, using a combination of bailing, surging, air-lifting, and pumping techniques.

Step Injection Test

The one-day injection step test was conducted on October 13, 2005, to evaluate the well specific capacity and to allow selection of an appropriate injection rate for the constant rate test. The step test was conducted at increasing injection rates of 39, 78, and 116 gallons per minute (gpm). Based on the results of the step test, a target injection rate of 120 gpm was selected for the 5-day constant rate test.

Constant Rate Injection Test

The constant rate injection test started on October 17, 2005, at 9:30 AM and was terminated on October 22, 2005, at 9:35 AM. During the test, the injection rate averaged 119 gpm. Data regarding injection well operations, such as injection rates and total gallons injected, are provided in the Excel spreadsheet located on the attached CD in the folder labeled "Operations Data".

By the end of the injection test the water level in the injection well had risen to a level approximately 9 feet above the top of the casing, or a total build up of approximately 64 feet above the original static water level (Figure 2).

After approximately 3.3 days (4,770 minutes) of injection, the rate of buildup on the semi-log buildup plot showed a steepening of the buildup trend (Figure 2). The initiation of the buildup increase correlated with the first change-out of the bag filters. A similar increase in buildup was not observed in the nearest Gage aquifer monitor wells indicating that the cause was associated with the injection well's efficiency rather than a change in the aquifer response. Based on the available data, the most likely cause of the increased buildup in PIW G-IW-2 is plugging of the well, most likely due to the presence of suspended sediment that was not completely removed by the bag filters.

Water Level Monitoring Results

The water level response in the surrounding area due to injection at PIW G-IW-2 was monitored using a combination of manual water level measurements and pressure transducers (Table 1). Manual water level data are provided in the folder labeled "Manual Water Level Data" (attached CD). Pressure transducer data are provided in the Folder Labeled "Transducer Data".

A barometric pressure transducer was also utilized to allow potential barometric influences to be evaluated, as necessary. Barometric pressure data were recorded from September 8 to October 28, 2006, and are provided in the folder Labeled "Barometric Data". Barometric pressure data were recorded in equivalent feet of water.

Aquifer Response

During the 5-day constant-rate phase of the test, a storm front moved through the area. Because of this, the variation in the barometric pressure was greater than normal. The barometric pressure exhibited a rising trend prior to and during the first two days of the test (Figure 3). The barometric pressure increased an equivalent of about 0.3 foot of water level between the second and third day of the test. By the end of the test the barometric pressure had returned to within 0.13 foot of the pressure at the start of the test.

The change in barometric pressure appears to have resulted in a decline of about 0.1 to 0.2 foot in the regional water levels measured manually in the Gage aquifer on the second day of the 5-day test. This results in a dip in the drawdown curve as shown on the hydrographs of manual measurements in the Gage aquifer monitor wells. Manual water level data were not corrected for this apparent barometric pressure effect since the impact appears to have diminished by the end of the injection period. The manual water level data from the middle of the injection period may need to be corrected if they are to be used in a model calibration exercise.

Transducer data collected from the Gage aquifer were also not corrected for barometric effects or regional drift due to the greater magnitude in the drawdown experienced in this unit. However, the buildup in the Bellflower sand (BFS) due to injection into the Gage aquifer was relatively small due to the presence of the fine-grained lower Bellflower aquitard which restricts the amount of leakance that can occur between these aquifer zones. The apparent buildup in the BFS was less than 0.5 foot which was similar to the barometric pressure changes and a slight regional rise in the BFS water levels which was apparent in the background wells. The BFS data therefore required correction in order to remove these effects and resolve the amount of buildup which occurred in response to injection. Several methods were investigated for correcting the BFS transducer data, however the method that was found to eliminate background influences most effectively was a simple subtraction of the water level change recorded by the transducer installed in the distant background



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monitor well BF-36. Corrected BFS transducer data are provided in the folder labeled "BFS Data".

No discernable injection-related buildup was observed in either the manual or transducer water level data collected from the Lynwood wells monitored during the test.

Figures showing the estimated buildup at the end of the injection phase of the test in the Gage aquifer and the BFS are provided (Figures 4 and 5).

Following the injection phase of the test, water levels were monitored in the same wells for a period of 5 days as water levels recovered back to static levels. Manual water level data and transducer data are included in the same files as the injection phase water level data.

Table 1
Pilot Well G-IW-2 Injection Test
Water Level Observation Wells

Well ID	Distance from G-IW-2 (ft)	Total Well Depth (ft bgs)	HSU (Montrose Designation)	HSU (Del Amo Designation)	Water Level Measured Manually	Water Level Measured with Transducer	Background Water Level Well
MW-4	8,021	75.3	UBA	MBFB sand		X	X
BF-13	258	138.0	BFS	MBFC sand	X	X	
SWL0011	284	110.5	BFS	MBFB sand	X		
SWL0013	294	150.5	BFS	MBFC sand	X	X	
SWL0041	336	93.5	BFS	MBFB sand	X		
SWL0040	358	137.0	BFS	MBFC sand	X	X	
SWL0018	519	141.0	BFS	MBFC sand	X	X	
SWL0052	525	95.0	BFS	MBFB sand	X	X	
SWL0055	880	131.1	BFS	MBFC sand	X		
BF-23	1,137	120.0	BFS	MBFC sand	X		
BF-10	1,233	131.0	BFS	MBFC sand	X		
SWL0019	1,417	90.6	BFS	MBFB sand	X		
SWL0027	1,727	137.0	BFS	MBFC sand	X		
BF-1	3,587	126.5	BFS	MBFC sand		X	X
BF-36	4,864	128.0	BFS	MBFC sand		X	X
BF-33	6,330	101.0	BFS	MBFC sand		X	X
G-11	251	218.0	Gage	Gage	X	X	
SWL0022	304	197.0	Gage	Gage	X	X	
G-17	1,065	213.0	Gage	Gage	X	X	
SWL0036	1,077	196.5	Gage	Gage	X	X	
G-12	1,126	198.0	Gage	Gage	X	X	
G-9	1,220	213.0	Gage	Gage	X	X	
SWL0034	1,408	178.0	Gage	Gage	X		
SWL0020	1,408	197.5	Gage	Gage	X		
G-13	1,636	197.0	Gage	Gage	X	X	
SWL0026	1,719	178.0	Gage	Gage	X	X	
SWL0025	2,048	222.0	Gage	Gage	X		
G-19A	2,060	204.0	Gage	Gage	X	X	
G-4	2,133	195.0	Gage	Gage	X		
G-06	2,407	192.0	Gage	Gage	X		
G-14	2,436	196.0	Gage	Gage	X		
G-16	2,580	187.0	Gage	Gage	X	X	
G-22	2,880	193.0	Gage	Gage	X	X	X
G-23	3,255	180.0	Gage	Gage	X		
G-1	3,348	164.5	Gage	Gage		X	X
LW-3	2,420	261.0	Lynwood	Lynwood	X		
LW-4	2,458	246.0	Lynwood	Lynwood	X		
LW-5	3,328	251.0	Lynwood	Lynwood		X	X

Footnotes:

ft = feet

bgs = below ground surface

HSU = Hydrostratigraphic Units

MW-# = UBA monitor well

BF-# = Bellflower sand monitor well

SWL# = Del Amo monitor well

G-# = Gage aquifer monitor well

UBA = Upper Bellflower aquitard

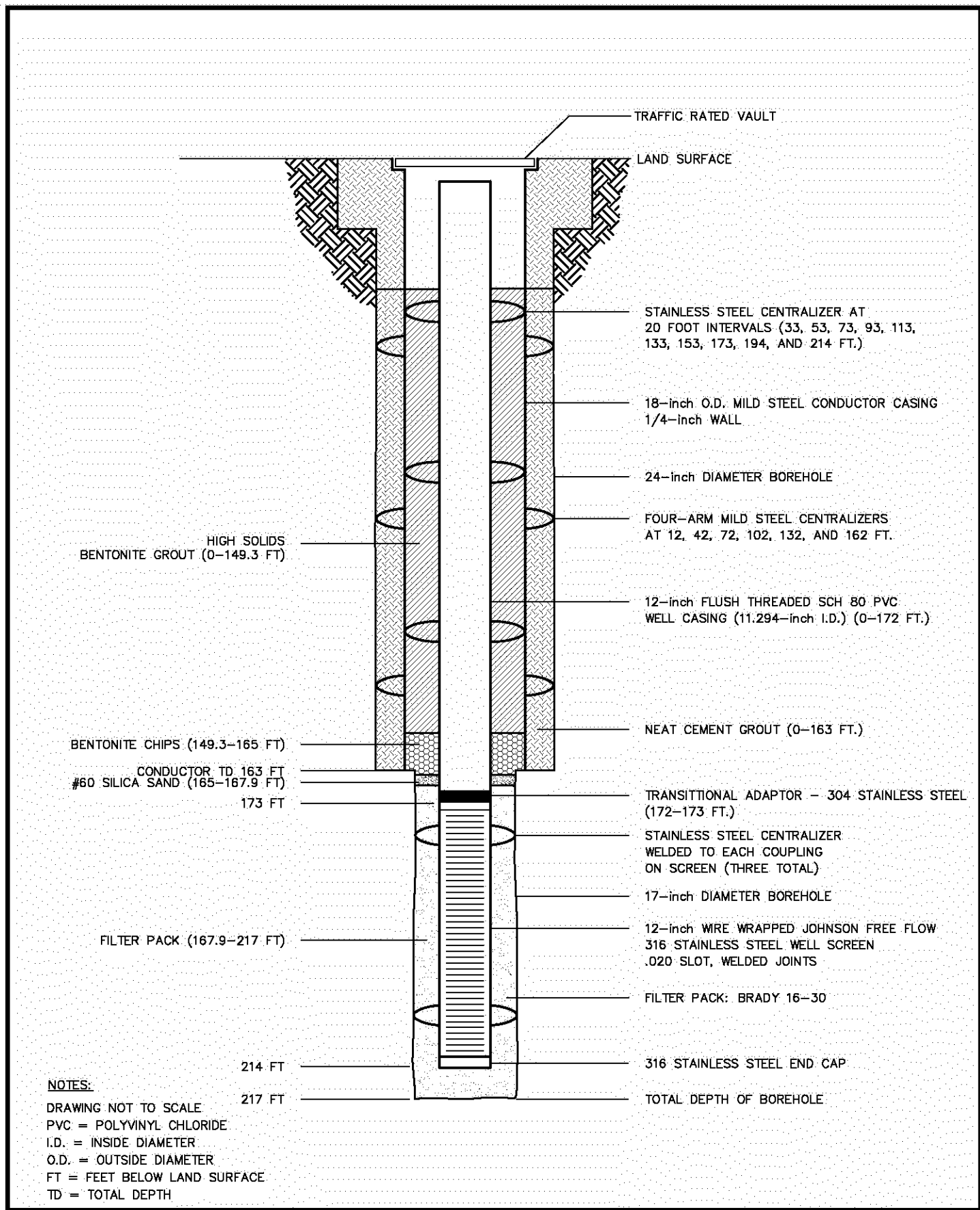
BFS = designates a monitor well screened in the Bellflower sand aquifer

Gage = designates a monitor well screened in the Gage Aquifer

Lynwood = designates a monitor well screened in the Lynwood aquifer

MBFB = Middle Bellflower B sand well

MBFC = Middle Bellflower C sand well



**FIGURE 1. AS-BUILT CONSTRUCTION DIAGRAM
PILOT INJECTION WELL G-IW-2**



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Figure 2

G-IW-2 Injection Buildup

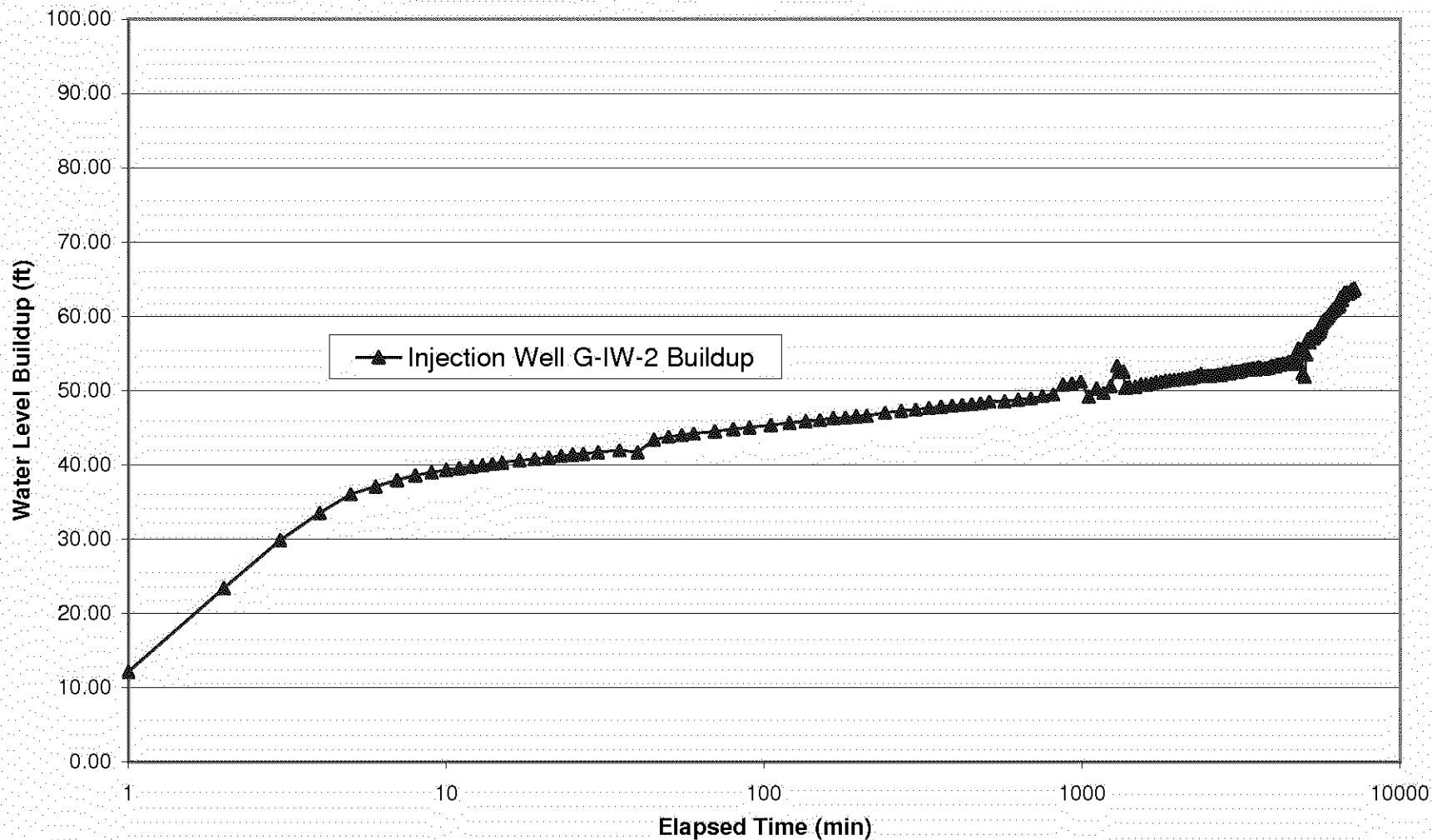
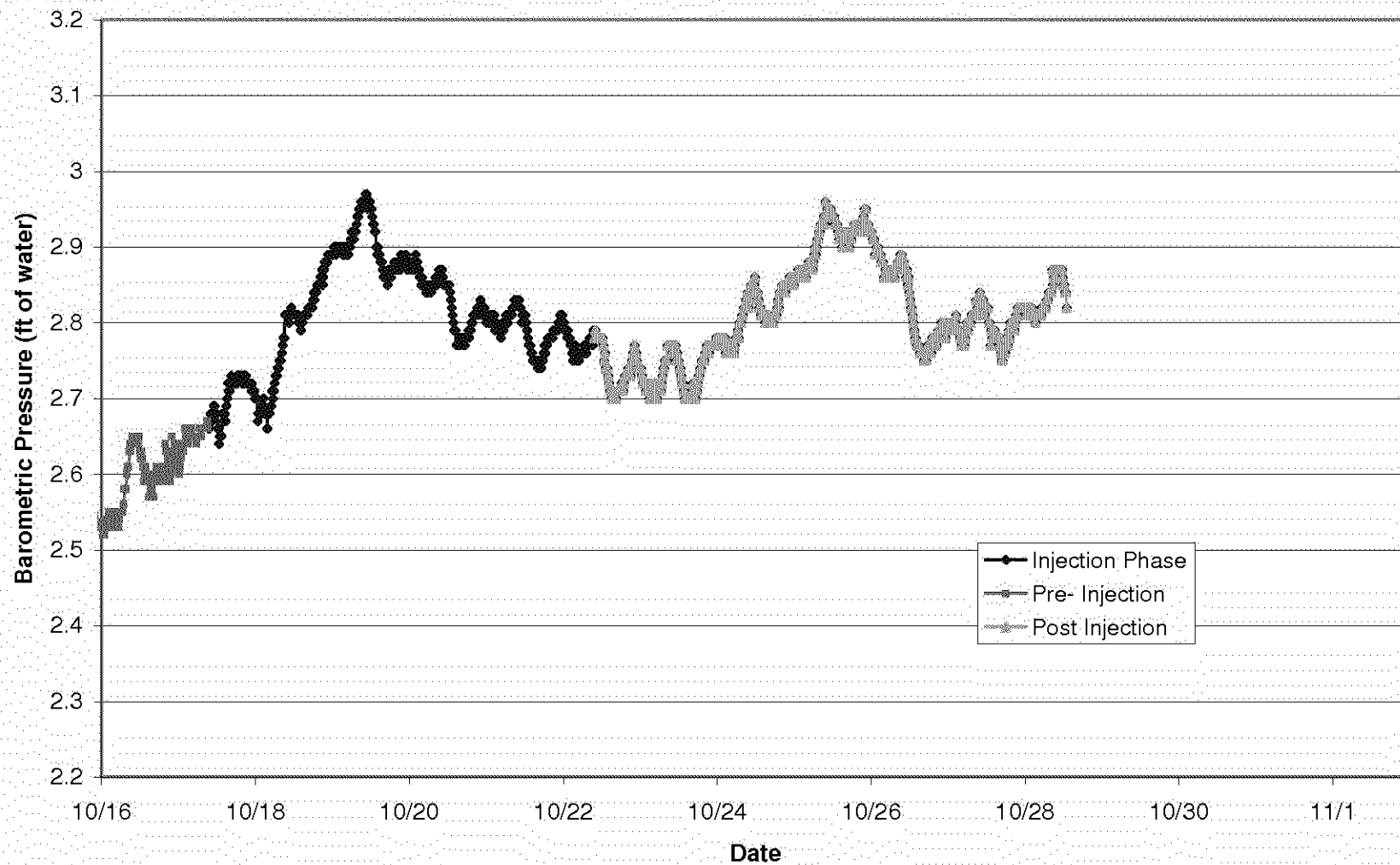
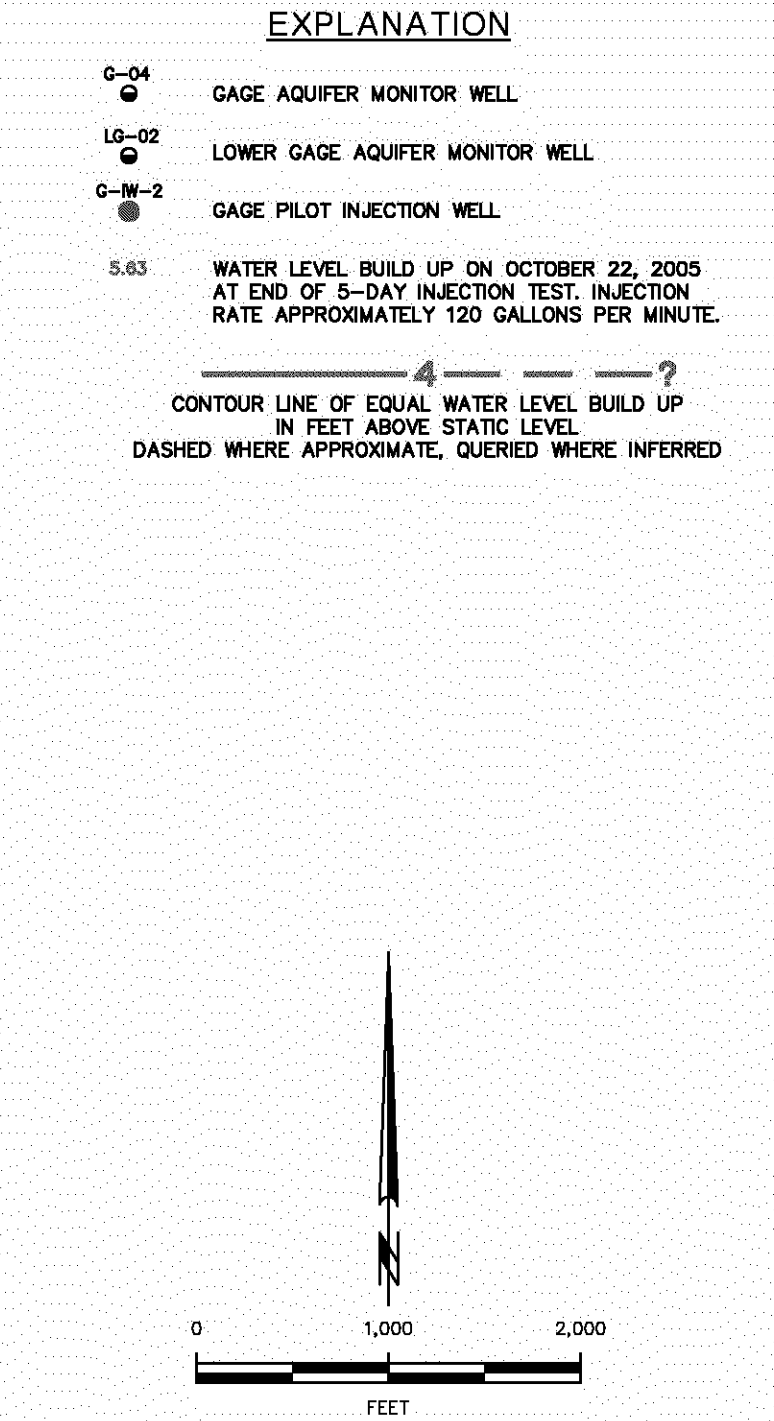
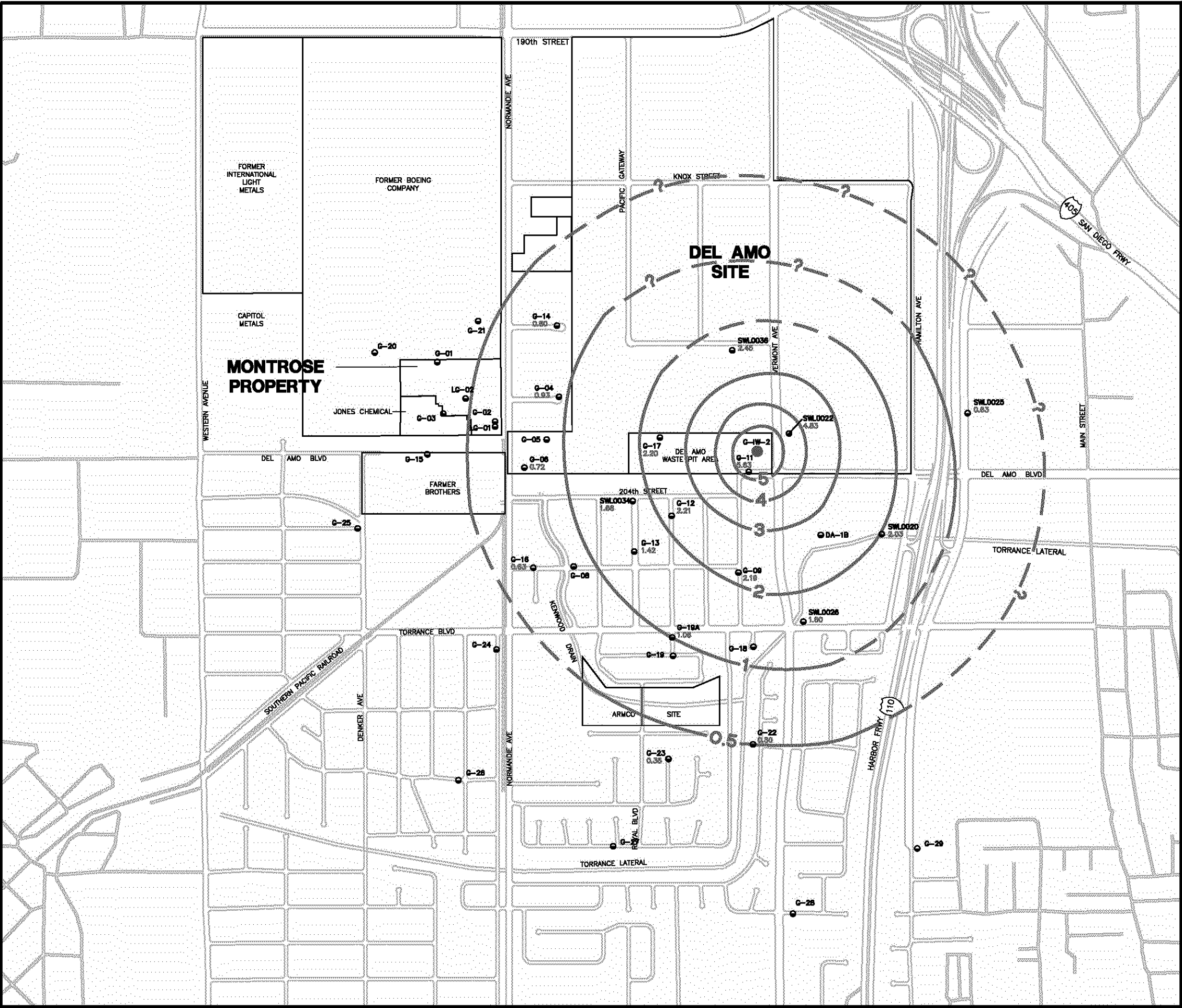


Figure 3

G-IW-2 Injection Test Barometric Transducer Data





MONTROSE CHEMICAL CORPORATION
TORRANCE, CALIFORNIA

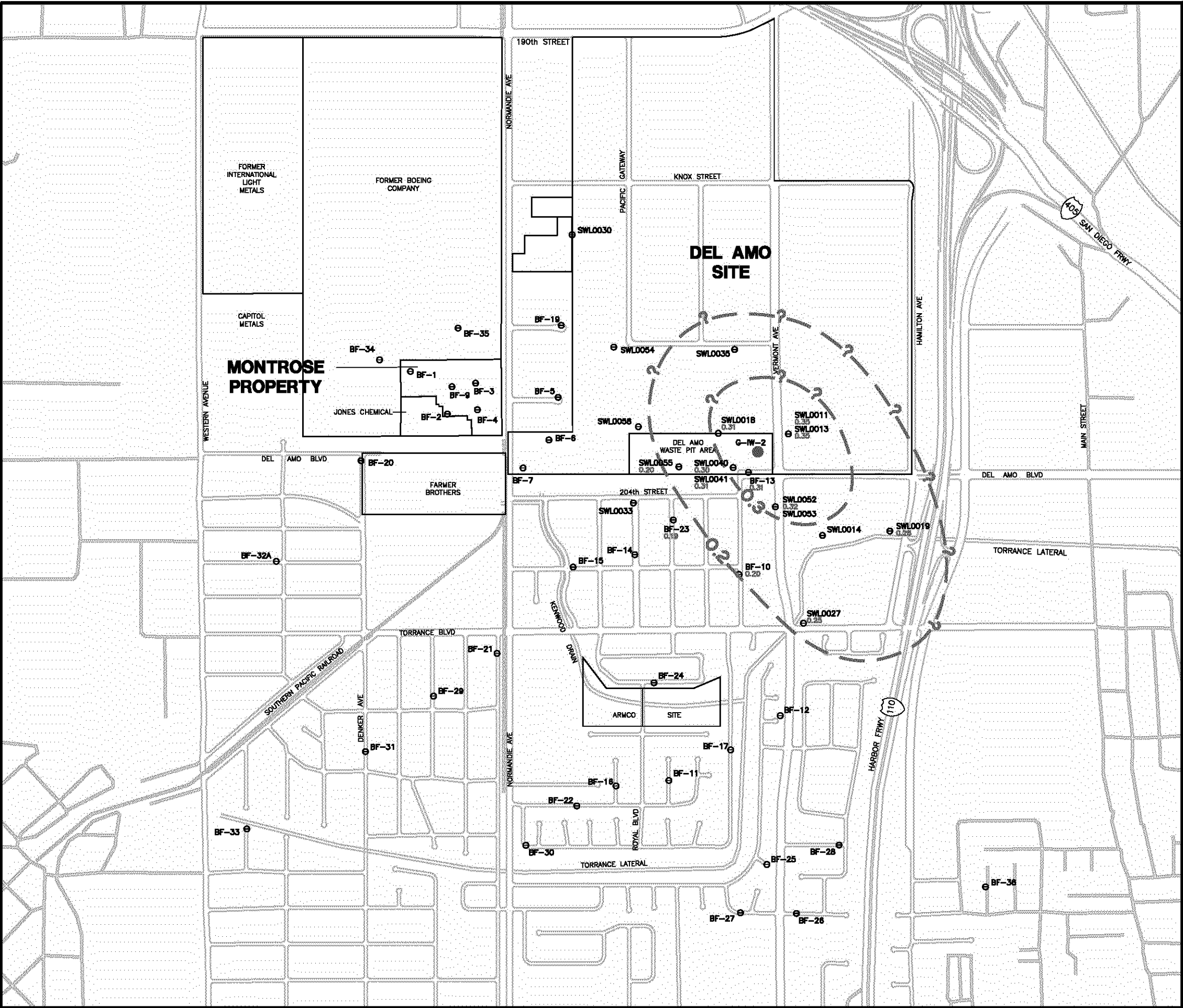
**WATER LEVEL BUILD UP
GAGE AQUIFER
PILOT INJECTION TEST, G-IW-2**

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FIGURE 4

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EXPLANATION

BF-18

⊖

BELLFLOWER SAND MONITOR WELL

G-IW-2

●

GAGE PILOT INJECTION WELL

0.28

WATER LEVEL BUILD UP ON OCTOBER 22, 2005
AT END OF 5-DAY INJECTION TEST. INJECTION
RATE APPROXIMATELY 120 GALLONS PER MINUTE.

0.2

CONTOUR LINE OF EQUAL WATER LEVEL BUILD UP
IN FEET ABOVE STATIC LEVEL
DASHED WHERE APPROXIMATE, QUERIED WHERE INFERRED

0

1,000

2,000

FEET

MONTROSE CHEMICAL CORPORATION

TORRANCE, CALIFORNIA

WATER LEVEL BUILD UP

BELLFLOWER SAND

PILOT INJECTION TEST, G-IW-2

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FIGURE 5

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